

## Claims

1. Internal combustion engine with at least one cylinder, in which a fuel/air mixture can be compressed in the cylinder by a piston, characterized in that the temperature of the fuel/air mixture in the combustion chamber can be brought to at least over 80% and up to at most 98% of the spontaneous ignition temperature of the fuel/air mixture and the ignition of the combustion is time-controlled through the introduction of laser light into the combustion chamber.
2. Internal combustion engine according to claim 1, characterized in that the temperature of the fuel/air mixture in the combustion chamber can be brought to at least over 85%, preferably over 87%, of the spontaneous ignition temperature of the fuel/ignition mixture.
3. Internal combustion engine according to claim 1, characterized in that the temperature of the fuel/air mixture in the combustion chamber can be brought to at most 95%, preferably at most 93%, of the spontaneous ignition temperature of the fuel/air mixture.
4. Internal combustion engine according to claim 1, characterized in that the mixture is formed outside the combustion chamber.
5. Internal combustion engine according to claim 1, characterized in that the mixture is formed in the combustion chamber.
6. Internal combustion engine according to claim 1, characterized in that the mixture is formed during the induction stroke.
7. Internal combustion engine according to claim 1, characterized in that the fuel/air mixture in the combustion chamber is at least in parts homogeneous.
8. Internal combustion engine according to claim 7, characterized in that the air/fuel ratio in the whole combustion chamber is approximately constant.

9. Internal combustion engine according to claim 7, characterized in that the air/fuel ratio is smaller in an area around the source of ignition than in the remainder of the combustion chamber.
10. Internal combustion engine according to claim 1, characterized in that the air/fuel ratio is greater than 1.5.
11. Internal combustion engine according to claim 1, characterized in that the air/fuel ratio is greater than 1.8.
12. Internal combustion engine according claim 1, characterized in that the geometric compression ratio is greater than 14.
13. Internal combustion engine according claim 1, characterized in that the geometric compression ratio is greater than 16.
14. Internal combustion engine according to claim 1, characterized in that it has at least one laser light source, at least one optical transmission apparatus and at least one coupling optic for the focussing of the laser light into the combustion chamber, onto at least one focus.
15. Internal combustion engine according to claim 1, characterized in that each cylinder has an antechamber-less main combustion chamber with in- and outlet valves and at least one focus of the laser light lies in the main combustion chamber.
16. Internal combustion engine according to claim 1, characterized in that it is a stationary engine.
17. Internal combustion engine according to claim 1, characterized in that the laser light source has a solid-state laser.

18. Internal combustion engine according to claim 1, characterized in that the solid-state laser is diode laser-pumped.
19. Internal combustion engine according to claim 1, characterized in that the solid-state is at least one of the group consisting of a Yb laser, a Nd laser and a Nd/YAG laser.
20. Internal combustion engine according to claim 1, characterized in that the laser light source comprises at least one laser diode the light of which enters the combustion chamber via a optical conductor and a coupling optic.
21. Internal combustion engine according to claim 20, characterized in that the optical conductor is flexible.
22. Internal combustion engine according to claim 1, characterized in that the laser light source comprises one of the group consisting of an actively and a passively Q switched laser.
23. Internal combustion engine according to claim 1, characterized in that the wavelength of the laser light lies above 400 nm.
24. Internal combustion engine according to claim 1, characterized in that the wavelength of the laser light lies above 1000 nm.
25. Internal combustion engine according to claim 1, characterized in that the pulse duration of a laser light pulse lies between 1 ns and 100 ns.
26. Internal combustion engine according to claim 1, characterized in that the pulse duration of a laser light pulse lies between 5ns and 50 ns.
27. Internal combustion engine according to claim 1, characterized in that the optical transmission apparatus comprises flexible optical conductors.

28. Internal combustion engine according to claim 1, characterized in that at least two laser light sources are provided for every cylinder.
29. Internal combustion engine according to claim 1, characterized in that the coupling optic has a combustion chamber window and outside the combustion chamber a lens or a lens arrangement for the focussing of laser light through the combustion chamber window into the combustion chamber.
30. Internal combustion engine according to claim 29, characterized in that the coupling optic has a combustion chamber window made of sapphire.
31. Internal combustion engine according to claim 1, characterized in that the combustion chamber window of the coupling optic is itself developed as a lens.
32. Internal combustion engine according to claim 1, characterized in that one of the group consisting of an electronic engine-control and an engine-regulating device is provided which, according to recorded engine parameters, triggers the laser light source(s) and in so doing establishes laser light parameters.
33. Internal combustion engine according to claim 32, characterized in that the recorded engine parameters are at least one of the group consisting of the crankshaft angle and the speed and the engine power and the current cylinder pressure in the combustion chamber.
34. Internal combustion engine according to claim 32, characterized in that the laser light parameters are at least one of the group consisting of the chronological sequence and the pulse duration and the ignition energy.
35. Internal combustion engine according to claim 1, characterized in that one of the group consisting of an electronic engine-control and an engine-regulating device is provided which controls or adjusts the ignition energy of at least a second laser light pulse(s) during the same working cycle of a cylinder, according to current cylinder pressure after the first laser light pulse.

36. Internal combustion engine according to claim 1, characterized in that the fuel/air mixture is ignited by at least two chronologically successive laser light pulses per working cycle of a cylinder.
37. Internal combustion engine according to claim 1, characterized in that one of the group consisting of an electronic engine-control and an engine-regulating device is provided which at the start of a working cycle establishes the air/fuel ratio, according to recorded engine parameters of at the directly preceding working cycle.
38. Internal combustion engine according to claim 37, characterized in that the recorded engine parameters are the cylinder pressures.
39. Internal combustion engine according to claim 1, characterized in that the geometric compression ratio can be varied.
40. Internal combustion engine according to claim 1, characterized in that the geometric compression ratio can be varied by an alternating piston.
41. Internal combustion engine according to claim 1 characterized in that the geometric compression ratio can be varied by swivelling the crankshaft.
42. Internal combustion engine according to claim 1, characterized in that the geometric compression ratio can be varied by a changing of the distance between the middle of the piston pin and the upper edge of the piston.
43. Internal combustion engine according to claim 1, characterized in that the geometric compression ratio can be varied by a pressure – dependent changing of the distance between the middle of the piston pin and the upper edge of the piston.

44. Internal combustion engine according to claim 1, characterized in that, after a pre-determined number of working cycles, a laser light pulse is emitted into the combustion chamber which is not filled with fuel/air mixture.
45. Internal combustion engine according to claim 1, characterized in that during the starting process of the internal combustion engine a laser light pulse is emitted into the combustion chamber which is not filled with fuel/air mixture.